locomotives of Field, Edison, Daft, and others, are given. Several electric railroads of some magnitude are at work in the States. Chapter VII. resumes the subject of street railways in which storage batteries are employed for driving the electric motors. The work done in this country by Mr. Reckenzaun receives due recognition, and Mr. Elieson's tramway engine is also described. The industrial application of electric motors in Europe and in America occupies the next two chapters, the special form of motors devised by Profs. Ayrton and Perry being noticed in the one and those of Griscom and Daft in the other. Electrically-propelled boats and balloons are treated by themselves; so also is the subject of telpherage. This subject—the transmission of freight along a wire road by electricity—originated with the late Prof. Fleeming Jenkin, and it has found imitators in America. The twelfth and last chapter is devoted to the latest American motors and motor systems, the motors of Brush, Sprague, Van de Poele, and others, being here described at length.

And here we must pause to point out the one blot on this otherwise excellent work: namely, that the entire theory of the self-regulating motor, which was discovered and worked out in 1882 by Profs. Ayrton and Perry, and which forms the basis of their epoch-making paper read in 1883 before the Society of Telegraph-Engineers, is appropriated *en bloc*, and accredited to Lieut. Sprague. From p. 160 it appears that Sprague's method of securing self-regulation is to use a differential compound winding; but this is exactly Ayrton and Perry's method. Even the equation on p. 161, which is given as the Sprague law of winding, is identical with the equation given on p. 367 of the present writer's book (edition of 1884) on dynamo-electric machinery in the section on the theory of the differential compound winding. Another matter credited to Mr. Sprague by the authors is the discovery of a motor which, when supplied at constant potential, runs faster when the strength of the magnetic field is diminished. But this is no new principle: it is an inherent law of nature, common to all motors old and new, being the simple converse to the equally fundamental fact that a dynamo, if it is to generate a constant electromotive force, must be run faster in a weak field, and may be run slower if the field is strengthened. Lieut. Sprague has done good work in producing motors of excellent design and having points of original merit: this we may freely acknowledge without ascribing to him what was known before his work was begun. The authors will do well to correct these slips in the second edition, which will probably soon be demanded. The book is creditable alike to authors and publisher.

SILVANUS P. THOMPSON

THE FLORA OF LEICESTERSHIRE

The Flora of Leicestershire, including the Cryptogams. With Maps of the County. Issued by the Leicester Literary and Philosophical Society. 372 Pages and 2 Maps. (London and Edinburgh: Williams and Norgate, 1886.)

THE county of Leicestershire covers an area of 800 square miles of the centre of England, at the summit of drainage between three of the great streams, the Trent, the Severn, and the Midland Ouse. Almost the whole of the county is at least 100 feet above sea-level. A large portion of the surface is between 300 and 500 feet, and Charnwood Forest rises at its highest point to 900 feet, so that Leicestershire is very different from such low-lying level Midland counties as Cambridgeshire, Bedfordshire, and Huntingdonshire. Half the area of the county is in grass, about one-quarter is under arable cultivation, and there are 20 square miles of woodlands. In Charnwood Forest there are slate and granite, and the sedimentary rocks are represented in the county from the middle of the Palæozoic to the middle of the Mesozoic series—Carboniferous Limestone, Coal-measures (Permian missed out), Trias, Lias, and Lower Oolite—so that there is every variety of soil.

Competent botanists have resided in the county for the last three generations. The fathers of Leicestershire botany are Dr. R. Pulteney, F.R.S., who was a surgeon at Leicester, and the author of "A General View of the Writings of Linnæus" (1781), and the well-known "Historical Sketches of the Progress of Botany in England up to the date of the general adoption of the Linnæan System" (1790); and the poet Crabbe, who lived at Belvoir from 1782 to 1813, when he removed to Wiltshire. Between 1820 and 1850 Leicestershire was the home of three clergymen, all of whom were enthusiastic botanists. The Rev. Andrew Bloxam lived at Twycross for more than forty years. He is best known as one of the special investigators of the British brambles, and partly, perhaps, because he worked them so thoroughly there is a general idea that Leicestershire is the richest county in England in forms of this complicated genus. He was one of the last survivors who kept up the old tradition of botany as it was in the days of Smith, Hooker, Turner, Dillwyn, and Forster, when a collector swept through the whole vegetable kingdom, from the flowering plants down to the fungi. The Rev. W. H. Coleman was a most energetic and capable botanist. He was for many years one of the masters of the Ashby-de-la-Zouch Grammar School, and it was he who laid the basis of the present work, dividing the county into a dozen districts, and tracing out the distribution of the plants through them as fully as he had opportunity. He died in 1864, and in 1875 his manuscript was handed over by his friend Mr. Edwin Brown, of Burton-on-Trent, to the Leicester Literary and Philosophical Society, which appointed a Committee to amplify and revise it. Of this Committee Mr. Mott, of Leicester, has acted as Chairman, and Mr. Carter, Dr. Finch, and Messrs. E. and C. Cooper are the other members. The other clergyman who worked in conjunction with Messrs. Bloxam and Coleman was the Rev. Churchill Babington, for many years the Disney Professor of Archæology at Cambridge, and now Rector of Cockfield, in Suffolk. In 1850 Miss Mary Kirby (now Mrs. Gregg) published a small flora of the county, which contained a substantially complete list of the flowering plants and ferns of Leicestershire, but no attempt was made to trace out their distribution in detail.

In the present work the number of flowering plants and ferns, native and naturalised, in Britain is estimated at 1546, and of these, 825 are admitted for Leicestershire. This number of 1546 is reached only by counting the subspecies of such variable types as *Ranunculus aquatilis* and

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Rubus fruticosus, and by including a large number of plants that have no claim to be considered as really wild, such as *Linaria Cymbalaria*, *Corydalis lutea*, and the wallflower. Mr. Watson's estimate was 1425, and, as compared with this, the flora of Leicestershire will stand at a little over 700. He worked out carefully in detail the distribution over the island of all these species, and showed that they fall into, broadly speaking, three geographical or climatic groups: that 532 species are spread generally over the whole island; that 606 species represent southern climatic and geographical influences; and that 238 species represent the boreal element in our flora, and are plants that are thoroughly at home only in the north of Scotland, and are found in England and Wales only in mountainous tracts. In any county, or other tract of land, the great mass of the flora always consists of the 532 generally-diffused plants, and the climatic difference between one county and another is shown by the extent to which the characteristically northern and southern types are represented. It adds very much to the interest which any book on local botany has for the non-resident general reader, if the writers keep these three climatic groups distinct in their minds, and give as complete an idea as possible of the way in which, and the extent to which, the austral and boreal types are represented in the area of which they treat. The writers of the present "Flora" have not attempted to give any general summary worked out upon this basis, and they are quite mistaken in supposing that their county includes three out of Watson's six climatic zones. Watson's infer-agrarian zone includes the low-level country south of the Humber and the Dee. Its characteristic types are such plants as *Clematis Vitalba*, *Rubia peregrina*, *Geranium rotundifolium*, *Trifolium subterraneum*, *T. suffocatum*, *Lathyrus Nissolia* and *L. Aphaca*, and *Centaurea Calcitrapa*. Watson's mid-agrarian zone includes the low levels of the north of England, up to a height of 900 feet above sea-level on the mountains of Yorkshire and the Lake District. Its upper limit is marked by the cessation (essential from climatic causes, not accidental) of fruticose Rubi, *Rosa arvensis*, *Pyrus Malus*, *Viburnum Opulus*, and *Alnus glutinosa*. Above this, up to the line of possible arable cultivation, extends the super-agrarian zone, with an average annual temperature of 42° to 45° F. The only county south of the Humber and Trent in which it is represented is Derbyshire. There do not appear to be in Leicestershire more than ten or a dozen out of the 238 boreal plants, such as *Lycopodium Selago*, *Empetrum nigrum*, and *Drosera anglica*, and these are either very rare or quite extinct. There is no saxifrage except *granulata* or *tridactylites*, no wild bird-cherry, no *Andreæa*, no *Polypodium Phegopteris* or *Dryopteris*. To understand their county and its flora in their proper relation to the rest of England, Mr. Mott and his colleagues must revise completely their ideas on this subject. The county would appear to be essentially a mid-agrarian outpost, pushed out from the Pennine Chain into the centre of England; for, out of the 600 austral types, not more than about 150 enter into it, which is fewer than there are either in North Yorkshire or at the Lakes. The limestone types, the occurrence of which is regulated more by soil than climate, appear to be well represented.

For the way in which the details of the flora are worked out, we have nothing to give but commendation. In the identification of the Phanerogamia, great pains has evidently been taken by the Committee. No doubt some of the species, which they admit on the authority of their predecessors, will prove to be blunders, as, for instance, *Tofieldia palustris*, *Carduus heterophyllus*, and *Asplenium viride*. When the members of the county society make their excursions into the different districts, they will be able to see at a glance what plants have been gathered there by their predecessors. The flora includes, not only the Phanerogamia and ferns, but also the mosses, Hepaticæ, lichens, Algæ, and fungi. It is not likely that there are many fresh Phanerogamia or ferns still to find; but as only 4 Characeæ, 179 mosses, 49 Hepaticæ, 177 lichens, and 446 fungi are known, there is ample scope for further work in all these orders. The portion of the book devoted to Algæ, which is ably edited by Mr. F. Bates, of Leicester, contains descriptive notes on many of the less known species. There is an interesting note on p. 344, on the species which have become extinct. They are 30 in number, and are nearly all plants of swamps and heaths, amongst them being *Lycopodium Selago*, *Osmunda regalis*, *Pinguicula vulgaris*, *Drosera anglica*, and *D. rotundifolia*.

The book will be still more interesting when we have good floras of Warwickshire, Nottinghamshire, Derbyshire, and Cheshire to compare it with, and for all these counties "Floras" are in course of preparation.

J. G. BAKER

GEOLOGY OF JERSEY

Géologie de Jersey. Par Le P. Ch. Noury, S.J. (Paris: F. Savy; Jersey: Le Feuvre, 1886.)

CONSIDERING that Jersey became subject to the Crown of England at the time of the Norman Conquest, English geologists may agree with M. de Lapparent's complaint as to the neglect the island has hitherto received. Although the Geological Society of London made it their earliest care to publish in 1811 (not 1817, as quoted in the opening of this little volume) MacCulloch's paper on the Channel Isles, although at the present time more than one worker is engaged in further removing the reproach, M. Noury is even now well to the front in providing in a handy form an account of the structure of Jersey serviceable to inhabitants and visitors alike. The character of this well-printed *brochure* presupposes, however, some general knowledge of geology, and the author is perhaps not so uniformly happy as, let us say, the Rev. W. S. Symonds in placing his facts before the intelligence of the untrained tourist. Some controverted matters, moreover, of purely speculative value are introduced, such as the construction of the primitive crust (p. 126), the succession in time of granite, syenite, and diorite, and the formation from these of schists and gneisses by disintegration in a heated ocean. The description of the prevailing rocks is the work of a close observer in the field; and the careful mention of such materials as have been artificially introduced ("cultivated rocks," one might almost call them) cannot be too highly praised. Future geologists will thus be spared the description of gneissic fragments (p. 6) imported as ballast from Brazil.

The suggested derivation of "pyromeride" (p. 29)—

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